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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Docket No: Q66023
Satoshi ARAKAWA	
Appln. No.: 09/943,353	Group Art Unit: 2878
Confirmation No.: 8693	Examiner: Constantine Hannaher
Filed: August 31, 2001	

For: METHOD AND APPARATUS FOR RECORDING AND READING OUT RADIATION IMAGES

REQUEST FOR RECONSIDERATION UNDER 37 C.F.R. § 1.111

MAIL STOP NON-FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated June 17, 2003, reconsideration and allowance of the subject application are respectfully requested. Claims 1-12 are all the claims pending in the application. Applicant respectfully submits the pending claims define patentable subject matter.

I. Preliminary Matters

The Examiner is requested to indicate acceptance the formal drawings filed along with the present application on August 31, 2001 in the next action.

II. The Present Invention

The present invention is directed to a radiation image recording and read-out apparatus and method, wherein a radiation image is stored on a stimulable phosphor sheet and the stimulable phosphor sheet is exposed to stimulating rays to release light in proportion to the amount of energy stored therein.

As shown in Figure 1, the radiation image recording and read-out apparatus comprises a radiation image recording section 10, a radiation image read-out section 20, and an erasing light source 40. The radiation image recording section 10 includes an object support base 12 for supporting an object 11, such as a human body, at a predetermined position and a stimulable phosphor sheet 2 supported at a predetermined position for image recording.

The radiation image read-out section 20 includes a read-out unit 21 for reading out a radiation image stored in the stimulable phosphor sheet 2. The read-out unit 21 includes a line light source (linear stimulating ray source) 22, a CCD line sensor 23, and a light collecting lens array 25. The read-out unit 21 is moved upwardly and downwardly by a ball screw 14 which is rotated by movement means 15.

The erasing light source 40 includes a plurality of fluorescent lamps 41 for irradiating the stimulable phosphor sheet 2 with erasing light to release energy which remains on the stimulable phosphor sheet 2 after the radiation image has been read out from the stimulable phosphor sheet 2 by the radiation image read-out section 20. The erased stimulable phosphor sheet 2 can then be used for recording a next radiation image.

A heavy metal-containing filter 42 is located on a surface 40a of the erasing light source

40 from which the erasing light is radiated out. The heavy metal-containing filter 42 is made of a lead-containing acrylic resin, a lead glass, or the like and is capable of transmitting the erasing light and absorbing the radiation 13. During the operation for recording the radiation image on the stimulable phosphor sheet 2, the heavy metal-containing filter 42 absorbs the radiation 13, which has passed through the stimulable phosphor sheet 2, and suppresses back scattering of the radiation 13. The heavy metal-containing filter 42 also filters out light components having wavelengths shorter than the wavelengths of the ultraviolet region. As a result, the erasing efficiency is enhanced because new energy is prevented from being stored on the stimulable phosphor sheet 2 due to the light components of the erasing light which have wavelengths shorter than the wavelengths of the ultraviolet region.

In operation, the object 11 is exposed to radiation 13, such as X-rays, produced by a radiation source (not shown) to record a radiation image of the object on the stimulable phosphor sheet 2. When the image recording operation has been finished, the read-out unit 21 is moved upwardly at a predetermined speed while producing stimulating rays 31 which are linearly irradiated to the stimulable phosphor sheet 2 to scan the stimulable phosphor sheet 2. The area of the stimulable phosphor sheet 2 exposed to the linear stimulating rays 31 emits the light 35 having intensity in accordance with the radiation image having been stored on the stimulable phosphor sheet 2. The emitted light 35 is collected by the light collecting lens array 25, impinges upon the CCD line sensor 23, and is received by the CCD line sensor 23. Thereafter, the erasing light source 40 is activated to produce the erasing light which is irradiated uniformly to the entire area of the stimulable phosphor sheet 2. When the stimulable phosphor sheet 2 is

exposed to the erasing light having wavelengths falling within the stimulation wavelength region for the stimulable phosphor sheet 2, energy remaining on a stimulable phosphor layer of the stimulable phosphor sheet 2 is released. Therefore, the stimulable phosphor sheet 2 is capable of being again utilized for the recording of a radiation image.

III. Prior Art Rejections

A. Disclosure of Saotome et al.

Saotome et al. (U.S. Patent No. 4,943,724; hereafter "Saotome") discloses a radiation image recording and read-out apparatus. As shown in Figure 8, the recording and read-out unit 201 includes a first wind-up shaft 241, a second wind-up shaft 242, and a stimulable phosphor sheet 202 wound around the first and second wind-up shafts 241 and 242. An image read-out section 220 is provided below the stimulable phosphor sheet 202 in the vicinity of the second wind-up shaft 242. The image read-out section 220 includes a stimulating ray source 221 for scanning the stimulable phosphor sheet 202 as the stimulable phosphor sheet 202 is conveyed by the first and second wind-up shafts 241 and 242. The portion of the stimulable phosphor sheet 202 for which the image read-out has been finished is wound up around the second wind-up shaft 242. After the radiation image recording has thus been carried out over approximately the overall length of the stimulable phosphor sheet 202, the first wind-up shaft 241 is rotated counter-clockwise such that the phosphor sheet 202 on which the image read-out has been finished and which has been wound around the second wind-up shaft 242 is returned to the first wind-up shaft 241. At this time, the stimulable phosphor sheet 202 passes over an erasing section 230 and is subjected to

image (residual image) erasing. The erasing section 230 includes a plurality of erasing light sources (fluorescent lamps) 231 positioned below the stimulable phosphor sheet 202 and producing erasing light having a wavelength within the stimulation wavelength range for the stimulable phosphor of the stimulable phosphor sheet 202. Upon exposure to the erasing light, the radiation energy remaining on the stimulable phosphor sheet 202 after the image read-out therefrom has been finished is released from the sheet 202.

As shown in Figure 9, a radiation shielding plate 208 formed of lead or the like and having an opening 208a of a predetermined size may be provided between an image recording table 214 and the stimulable phosphor sheet 202 at the image recording position. Subdivision image recording may be carried out by use of the radiation shielding plate 208 in order to record two or more images side by side on a single image recording area.

B. Disclosure of Horikawa

Horikawa (U.S. Patent No. 5,099,119) is directed to an image recording and read-out apparatus. As shown in Figure 1, an image recording section 10 includes an endless recording belt 1 having a stimulable phosphor layer, a recording table 14 for supporting an object 12 of which a radiation image is to be recorded constitute, and a radiation source 11 for emitting X-rays is disposed above the recording belt 1 and a recording table 14. The endless recording belt 1 is supported and circulated by a first roller section 40 consisting of conveyor rollers 41, 42 and a second roller section 50 consisting of conveyor rollers 51, 52.

In the image recording section 10, when the radiation source 11 is activated with an object 12 lying on the recording table 14, radiation passing through the object 12 produces a radiation transmission image of the object 12 on the recording belt 1 and this radiation image information is stored in the stimulable phosphor layer of the recording belt. During image recording, the recording belt 1 is stopped so that the portion thereof on which image recording is to be carried out stands opposite to the radiation source 11. After image recording has been completed, the recording belt is then conveyed by the rollers 41, 42, 51, 52 in the direction of the arrows so as to bring the portion thereof that carries the recorded image to an image read-out section 20. The image read-out section 20 includes an optical system for scanning the recording belt 1 with stimulating rays to read out the image information stored on the recording belt 1. The portion of the recording belt 1 exposed to the stimulating beam emits light in proportion to the image information stored thereon and the emitted light is detected by a photoelectric read-out means 70.

Following completion of the read-out operation, the portion of the recording belt from which image information has been read out is conveyed to an erasing section 30 by the first and second roller sections 40, 50. The erasing section 30 includes a case 31 and a number of erasing light sources 32 (fluorescent lamps) emit light having a wavelength within the stimulation wavelength range for the stimulable phosphor layer of the recording belt. A lead plate 2 is disposed beneath the recording table 14 so that portions of the recording belt 1 located at the image read-out section, the erasing section and elsewhere within the apparatus will be shielded from, and thus unaffected by, radiation emitted by the radiation source 11 during image

recording. Following completion of the erasing operation in the erasing section, the erased portion of the recording belt is again conveyed to the image recording section 10 where it can again be recorded with radiation image information.

C. Disclosure of Takashi et al.

Takashi et al. (U.S. Patent No. 5,113,078; hereafter "Takashi") discloses a transparent radiation shielding structure which may be used for a work face of a glove box that is designed to handle radioactive substances safely. The transparent radiation shielding structure includes a radiation shielding panel which comprises a lead transparent plate, such as a transparent lead acrylic resin plate or lead glass plate, and a thin non-lead transparent plate, such as a transparent acrylate resin plate or glass plate, which is laminated on at least one side of the lead transparent plate. Lead that is contained in the lead transparent plate shields radioactive rays, while the non-lead transparent plate, which is laminated on at least one side of the lead transparent plate, prevents oxidation of the lead in the lead transparent plate by air or chemicals.

D. Analysis

Claims 1-5 and 7-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Saotome in view of Horikawa and Takashi. Claims 6 and 12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Saotome in view of Horikawa and Takashi and Ohyama et al. (U.S. Patent No. 4,767,927; hereafter "Ohyama"). Applicant respectfully traverses the prior art rejections.

The Examiner maintains Saotome (Fig. 8) discloses all of the features of independent claims 1 and 7 except for "the locating of a filter on the side of the erasing light source 230 which faces the stimulable phosphor sheet." However, the Examiner asserts that "[i]n view of the advantageous shielding afforded by the presence of lead plate 2 as taught by Horikawa (column 7, lines 45-51), it would have been obvious ... to modify the method of Saotome et al. to comprise locating a filter which has good absorbing properties with respect to the radiation on the side of the erasing light source 230 which faces the stimulable phosphor sheet 202." Further, the Examiner contends "one of ordinary skill in the art would have had a reasonable expectation of success that a lead plate as suggested by Horikawa could shield the apparatus from radiation while, in view of the suggestion of Takashi et al. [regarding a transparent lead plate], still having transmitting properties with respect to the erasing light."

Applicant respectfully submits the invention recited in independent claims 1 and 7 would not have been rendered obvious in view of the combination of Saotome, Horikawa and Takashi, as asserted by the Examiner. In particular, Applicant respectfully submits one of ordinary skill in the art would not have been motivated to modify Saotome to produce the claimed invention based on the teachings of Horikawa and Takashi.

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, there must be some suggestion or motivation to modify to combine the reference teachings. In particular, "[t]o support the conclusion that the claimed invention is directed to obvious subject matter, either references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed

invention to have been obvious in light of the teachings of the reference." *Ex parte Clapp* 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).

In the present case, Applicant respectfully submits one of ordinary skill in the art would not have been motivated to modify the device of Saotome to include a lead plate as taught by Horikawa, as the Examiner contends, because such modification would render the device of Saotome unsatisfactory for its intended purpose. That is, as the Examiner recognizes, utilizing a lead plate, as taught by Horikawa, on the side of the erasing light source 230 which faces the stimulable phosphor sheet 202 in the recording and read-out unit 201 of Saotome would cause prevent the erasing light emitted from the erasing section 230 from exposing the stimulable phosphor sheet 202. (i.e., the radiation energy remaining on the stimulable phosphor sheet 202 after the image read-out could not be released from the sheet 202). However, it is well settled that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is not suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See MPEP 2143.01.

In addition, Applicant respectfully submits one of ordinary skill in the art would not have been motivated to modify Horikawa by replacing the lead plate 2 of with a transparent lead plate, as taught by Takashi, because doing so would not provide any benefit or serve any useful purpose. In particular, since the light emitted from Horikawa's erasing section 30 never reaches the lead plate 2 (i.e., to ensure thorough light shielding, the nip roller pairs 61, 62 and the side of the recording belt opposite from that facing the erasing light sources 32 are covered with a shield

plate 63), there would have be no reason for one of ordinary skill in the art to replace the lead plate 2 with a transparent lead plate.

Further, Takashi does not provide any motivation or suggestion to modify Saotome or Takashi to utilize "a filter, which has transmitting properties with respect to the erasing light and has good absorbing properties with respect to the radiation, ... located on a side of the erasing light source, which side stands facing the stimulable phosphor sheet", as claimed. Rather, as discussed above, Takashi merely discloses a radiation shielding panel which includes a lead transparent plate and is used for a work face of a glove box for handling radioactive substances.

According to the claimed invention, it is important to provide an image read-out section and an erasing light source on a surface of the stimulable phosphor sheet which is opposite to a surface of the stimulable phosphor sheet exposed to the radiation in order to reduce the size of the apparatus. Further, the claimed invention provides for the prevention of back scattering and for the transmission of the erasing light. However, Takashi does not teach or suggest these features of the claimed invention.

In view of the above, Applicant respectfully submits the Examiner is impermissibly using claimed invention as a "blueprint" to select features of prior art references to reconstruct the invention since the applied references clearly lack any teaching which would provide the requisite motivation that would have led one of ordinary skill in the art to modify the apparatus taught by the Saotome to arrive at the claimed invention. However, it is well settled that an Examiner is prohibited from using his knowledge of the present invention, in hindsight, to establish a *prima facie* case of obviousness. See *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 227